

## CHAPTER 2. MEDICAL EQUIPMENT MAINTENANCE INFORMATION

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### 2-1. ACT 10 BLOOD ANALYZER, 6630-01-468-9142 (BECKMAN COULTER)

a. There have been some problems noted with crystallization in the lines causing erroneous readings. When the analyzer is to be stored for long periods of time or shipped to another location, it is important to follow 4.15 in the OEM literature. After completing this procedure, it is it is advisable to do the following:

- (1) Enter the diluter screen by pressing the sample button while turning the unit on.
- (2) Press various icons, including "wet prime", "drain baths" and "dry prime" icons several times to cycle as much fluid out of the system as possible.
- (3) Using a luer lock syringe, open any lines with visible fluid in them and withdraw the fluid.
- (4) Remove the pump tubing from the pumps to maintain the shape and pliability of the tubing.

b. Replace dilutant filters every 5000 cycles or 6 months. If you have frequent or erroneous dilutant errors this is the first step to correcting them.

### 2-2. ANESTHESIA APPARATUS, 6515-01-457-1840

a. EXTERNAL O<sub>2</sub> AND N<sub>2</sub>O REGULATORS VERIFICATION - Draeger does not provide verification procedures for the external O<sub>2</sub> and N<sub>2</sub>O regulators used on the NARKOMED M anesthesia machine. The USAMMA has developed procedures to verify the performance of the regulators. The test procedures verify that the regulators operate according to Flotec specifications.

b. Appendix E illustrates the verification steps for the O<sub>2</sub> regulator, part #RN510-600. Appendix F illustrates the verification steps for the N<sub>2</sub>O regulator, part #RNJM05-6005.

### 2-3. ANESTHESIA MACHINE, 6515-01-533-0968/6515-01-533-0398 (OCEANIC), MAGELLAN, MODELS 1 AND 2

a. It is imperative that the water trap supplied with the Magellan Anesthesia Machine be installed whenever the compressor is in use.

b. The compressor for this anesthesia machine does not have a dehydrator connected to it. The manufacturer of the ventilator and compressor (Smiths Medical) has found that over a period of 72 hours, a cup or more of water can be accumulated in the water trap and air lines.

c. Ensure that the water trap is always installed to prevent damage to the equipment and injury or death to the patient

6515-01-533-0968  
Anesthesia Machine

d. When verifying vaporizers two things, altitude and temperature, can significantly affect your readings. Vaporizers should be verified after the unit has been stabilized for 4 hours at 20C  $\pm$  1 degree (approximately 70F). Altitude compensations are as follows.

Altitude	multiply by
2000 Ft.	.9
4000 Ft.	.85
6000 Ft.	.8

#### **2-4. ARTHROSCOPIC SYSTEM, 6515-01-431-9631**

a. During preventive maintenance checks and services (PMCS) on the Olympus-America, Inc. Arthroscope, the fiber optic bundle should be inspected carefully, ensuring that it still has 80 percent light conductivity and no breaks in the center of the bundle. PMCS includes a visual inspection of the equipment for any damaged parts or deficiencies that will prevent the unit from being used or sterilized.

b. The Arthroscope System comes with one each of the following items:

3093, Fiberoptic cable, 6515-01-139-8567  
7584, Single sheet with stopcock (OBTURATOR, CONICAL), 6515-01-166-3504  
7599, Trocar, Pyramid, 6515-01-166-3528  
7600, Trocar, Blunt Tip Sleeve, 6515-01-173-2452  
7595, Scope, 6515-01-171-6050

#### **2-5. BATTERY SUPPORT SYSTEM, 6625-01-192-9460**

Electrical safety testing of the Battery Support System for use with Physio Control's Defibrillators/Monitors Life Pak 5 has two items to note:

a. Case leakage of the Battery Support System should be less than 100uA with both an open ground and normal ground. In order to make a good ground contact, insert a probe in the rear vents of the unit and make contact with the heatsink.

b. Ground resistance for the Battery Support System cannot be verified using a safety analyzer. Verify resistance using a multimeter from the AC ground pin to the negative battery terminal in the battery (charging) compartments. The reading should be less than .66 ohms.

#### **2-6. COMPRESSOR-DEHYDRATOR, DENTAL, 6520-01-398-4613**

a. Overheating during extended operation is a common problem.

(1) Only affects units with serial numbers of 0950 and below. Originally manufactured units were wired so that the cooling coil fan would de-energize during the purging cycle.

(2) Defiance Electronics has authorized the government to correct the wiring on the pressure switch.

b. Quick Check:

(1) During the purge cycle, simply touch the center of the fan and ensure that the fan remains energized.

(2) If the fan does not remain energized the unit must be modified.

c. Modification Procedure:

- (1) Remove the pressure switch cover.
- (2) Disconnect the fan wire from inside the pressure switch.  
This is the larger black wire on the lower right side that goes to the fan.
- (3) Reconnect the fan wire so that it is connected before the pressure switch.  
Connect to the upper right terminal.
- (4) Replace pressure switch cover and perform the quick check again to ensure proper operation.

## **2-7. COMPUTED RADIOGRAPHY, 6525-01-504-5002**

a. Cassette Error and Replacement Issues

(1) A common problem with the Orex PcCR 1417 system is that when the cassettes are being erased or scanned an error will sometimes pop up on the screen. The Error reads "WO Sensor ON State Fail." To correct this, Source One's guidance was to pull down on the cassette tabs and tap the closed end of the cassette on a table. This ensures that the plate on the inside of the cassette is positioned at the very bottom of the cassette. When the cassette is run again the error message may be gone.

(2) In the event that this does not correct the problem, Source One recommends that the plate be taken out of the cassette, turned 180 degrees, and installed back into the cassette. Make sure to position the plate to the bottom of the cassette by again pulling down on the tabs and tapping the cassette on a table. If this does not correct the problem, it is time to order another cassette. At the time of the above referenced discussion, the price for a 14 x 17 cassette w/plate was \$1,290 each. Doing these extra steps to increase the life of your cassette w/plate may help save precious resources.

b. Computed Radiography System Software Issues

(1) The Army started purchasing the Orex PcCR 1417 system approximately 3 years ago. Since then there has been about 266 scanners purchased. Of these 266 scanners we have 4 different hardware versions (96 of the first version, 71 of the second version, 12 of the third version, 87 of the forth version) and about 21 different software versions. The scanner interface software has changed 16 times and the application software has changed 5 times. Orex has released a new improved version of the parts manual. Still, it has a very limited quantity of part numbers.

(2) Tobyhanna is dedicated to provide Orex support. To help simplify the software issue all the different versions of the software have been tested and the number of Orex Scanner Interface Software versions have been reduced to three, and one version of the application software.

(3) About 80% of the problems with these systems in the field are software related, mostly as a result of using the computers for web access. Please do not use the computer for internet purposes.

(4) To help reduce some of the frustration in the field, we have made a DVD System Disk for this system. With this disk you may reload the complete software on the hard drive on any version of the scanner. Along with the software are the latest manual updates, and the instructions and software needed to configure the system for DICOM In, Modality Worklist, Remote Patient Entry, and Diagnostic Viewer. We have also made a list of all the scanners by serial

number and listed the software they should be using. We are constantly updating this disk to ensure the latest Operator's, Service, and Parts manuals are available.

(5) Questions or comments should be directed to 570-895-7734 or DSN 795-7734.

## **2-8. CONCENTRATOR, OXYGEN, 6515-01-434-4629**

a. When testing the AIRSEP oxygen concentrator for purity, it is recommended that you use a Fluke Biomedical Gas Flow Analyzer, model VT Plus or equivalent O2 measuring device with a waveform producing capability. The VT Plus produces a waveform which enables you to identify occasional O2 output purity fluctuations. This waveform should remain fairly level and fluctuation of the oxygen levels should be minimal.

b. When using alternative test equipment to verify the concentrator, it may appear as though the concentrator is passing the purity tests, however, visibility of intermittent fluctuations where the purity drops below acceptable oxygen levels may be unseen. Low purity is primarily a result of bad sieve beds. Additionally, a bad mixing tank can also cause fluctuations in the oxygen purity. Anytime you replace the sieve bed assembly, Part Number BE001-1R, you should also replace the mixing tank assembly part # TA-089-2.

c. There are two versions of this O2 concentrator on the market. The newer version includes a design change that is not in the OEM service manual. In the older version, the pressure outlet is located on the right side as you face the front of the unit. In the newer version, the pressure outlet is in the rear of the unit, however access it from the right side. Remove the right side cover and locate the tube with the pressure outlet attached. Connect your pressure gauge to this tube. All other aspects of the testing are the same.

## **2-9. DEFIBRILLATOR, MONITOR RECORDER, 6516-01-515-4197**

### **a. Non-Invasive Blood Pressure (NIBP) Leak Testing Procedure**

(1) Zoll Medical Corporation is in the process of publishing revised NIBP leak testing limits (PM Procedure #20.0) to reflect the variances between the two different testing methodologies associated with different types of NIBP Analyzers.

(2) Zoll's service manual calls for a BIO-TEK BP Pump NIBP Monitor Analyzer or equivalent in its testing procedures. The requirement to identify two different limits is based on the use of a test cuff when using the DNI CUFFLINK Analyzer.

(3) Zoll has identified the following leak test limits for the two types of Analyzers:

(a) BIO-TEK BP PUMP NIBP MONITOR ANALYZER - No change.

test.

- A volume leak reading less than or equal to 4 mmHg, the unit passes the
- A volume leak reading greater than 4 mmHg; the unit fails the leak test.

(b) DNI CUFFLINK ANALYZER

test.

- A volume leak reading less than or equal to 10 mmHg, the unit passes the
- A volume leak reading greater than 10 mmHg; the unit fails the test.

(4) This information provided by the Senior Technical Support Representative, Zoll Medical Corporation. Phone: 1-800-242-9150 ext. 9195, e-mail [jtoma@zoll.com](mailto:jtoma@zoll.com).

b. CCT Defibrillators Software Update

(a) On Aug. of 2004 Zoll updated the M series CCT defibrillators software from Rev. 56.00 to Rev. 57.00. This update only affects the summary report, nothing else. The manufacturer has advised that if a defibrillator needs the software update but has recently had a full PM inspection or is within its calibration date, another full PM is not necessary following the software update.

(b) All that needs to be checked is the summary report test, which is step 14.0 (14.0 – 14.4), in the manufacturer's service manual test procedures. Nothing has changed on the Summary Report Test procedure; perform this test just as stated in the service manual. The manufacturer does not foresee another update in the immediate future.

## 2-10. DENTAL OPERATING UNIT, FIELD, 6520-01-493-3759 (AKA "DEFTOS")

a. When unpacking the Bell Dental Products Field Dental Operating Units sent to our medical maintenance operations depots for maintenance and repair, we are finding the hoses in pouch number 2 to be pinched due to improper packing. This is caused when the unit is packed backwards (front of unit facing back of case) and when the contents of pouch number 2 are not properly packed.

b. The unit should always be packed in the case with the front of the unit facing the front of the storage case, as stated in the operating and service manual. This will protect the circuit breakers as well as the connectors, which are on the back of the unit. This will also give a flat surface to help protect the contents of pouch number 2 from being pinched. When packing the pouches, the hoses and cords should be coiled so that the diameter of each coil is as wide as possible to ensure that the pouches are not too thick when placing them into the storage case. When the pouches are too thick, the hoses tend to get pinched from the force placed on them. The laminated instruction cards should also be placed between pouch number 2 and the instrument tray assembly to ensure that the tray support doesn't pinch the hoses.

## 2-11. ELECTROSURGICAL APPARATUS, 6515-01-309-6647

a. There are two versions of the Valleylab, Force 2 electrosurgical unit. The PRSF board in the Force 2 generator changed in 1995. You can determine the year of manufacturer of your equipment by the serial number. Example F6E9999T

F6E9999T Breakdown				
F	6	E	9999	T
Force 2	last number of the year of manufacturer	month of manufacture	body of 4 numbers indicates it was manufactured 1985 thru 1995 and was the 9999th unit made. A body of 5 numbers indicates it was manufactured from 1995 thru present.	also stands for Force 2
In this example the Force 2 was manufactured in May of 1986 and it was the 9999th unit manufactured.				

b. Units manufactured before 1995 have a verification procedure as well as a calibration procedure in the OEM service manual. Units manufactured after 1995 have only a calibration procedure.

c. It has been determined that the default auto sequence in the Fluke Biomedical 454A Electrosurgical Analyzer does not meet Valleylab's standard for testing the Force 2 generators. An auto sequence can be manually created in the 454A that will meet the Valleylab test standard of a

200 ohm load when doing RF output tests. The following tests must be entered into the auto sequence.

- (1) Generator Output tests with a 300 ohm load at the following settings.

Coag	30 Watts
	120 Watts
Pure Cut	300 Watts
Blend 1	250 Watts
Blend 2	200 Watts
Blend 3	150 Watts
Microbipolar	70 Watts

- (2) RF Leakage tests with a 200 ohm load, both active and dispersive leads at the following settings. Use the following identified wattage setting.

Pure Cut	35	55	75	95	115	135	155	175	195	300
Coag	55	75	105	115	120					
Microbipolar	70									

- d. Do not use a disposable pencil to test the RF Leakage, this will give you false readings. Use the active accessory and activate it using the footswitch.

## 2-12. GENERATOR, OXYGEN, MEDICAL, POGS, 6530-01-533-4481

a. The POGS33C is the oxygen concentrator from ONSITE GAS SYSTEMS. It is capable of delivering 33 LPM while maintaining 93% - 96% oxygen. During setup it is imperative that the O<sub>2</sub> analyzer be calibrated correctly. While the calibration does not effect the actual production of O<sub>2</sub>, the analyzer readings are used to alert operators in the event of low O<sub>2</sub> production.

- (1) The generator needs to run for 45 minutes prior to calibration.

(2) During this period, install three flow meters and set them to a combined flow of 30 LPM. This allows the existing gases in the O<sub>2</sub> tank to be purged by the O<sub>2</sub> from the sieve beds.

(3) After the 45 min start-up period, factory representatives advise to calibrate at the High range first, then the Low (20.9%) and then the High again.

b. The VT PLUS gas flow analyzer may be used to calibrate the High range of the O<sub>2</sub> analyzer. Build a manifold to connect three flow meters to the VT PLUS using tubing, swivel connectors and zip ties.

c. The POGS33C uses a model MedAir 2000 CO (carbon monoxide) and Dew Point monitor from ENMET Corporation which is mounted internally. If there is an alarm coming from within the generator, although one should not rule out the possibility that high levels of CO are present, it is possible that the MedAir 2000 is out of calibration.

- (1) The following is a list of items ENMET Corporation recommends to verify the calibration of the MedAir 2000:

Gas Regulator	037-00-500	\$145
CO Cylinder	03219-020	\$50
O <sub>2</sub> Cylinder (20.9%)	03296-209	\$50
Case (Optional)	730-83-000	\$20

- (2) Additional information is available in the MEDAIR 2000 manual which should accompany the POGS 33C literature.

## **2-13. LIGHT, FIELD SURGICAL, 6530-01-343-2033**

Battery disconnection procedures.

a. While the Gettlinge Castle model 2410MB field surgical light is in storage, the two 12VDC batteries need to be disconnected. The previous method for disconnecting the batteries includes removing the base cover (6 screws) and removing the battery hold down bracket (3 nuts). The batteries are then maneuvered out of position to allow access to the terminal screws. Once disconnected and tucked back into position, you must then reinstall the battery hold down bracket and base cover. While this is not a difficult exercise, it is rather cumbersome and time consuming.

b. It has been determined that there is a more practical solution which takes less time. After removing the base cover, simply disconnect the J1 connector from the RELAY PCB. This effectively removes both batteries from the circuit. There is no wrestling with bracket or batteries. A "BATTERIES DISCONNECTED" sticker can be used to secure the J1 connector in a position that will prevent damage and ensure that the next technician reconnects during set up procedures.

## **2-14. MONITOR, VITAL SIGNS, PRINTER DOOR ASSEMBLY (6515-01-423-5796, 6515-01-423-5872, 6515-10-432-2707 AND 6515-01-432-2711)**

A printer door assembly problem has been identified in the models 100 series, 200 series, and Encore Propaq Vital Signs Monitors, NSNs 6515-10-432-2707, 6515-01-432-2711, 6515-01-423-5872, and 6515-01-423-5796, that allows the printer door linkage that activates the printer when the printer is closed to become disconnected under normal use. The symptoms include the printer not functioning or printer door not staying closed.

a. A washer and a retaining grommet are available that affixes to the tab of the door pin prohibiting the linkage from coming disconnected.

b. For additional information regarding this issue contact your regional Medical Maintenance Operations Division.

## **2-15. MONITOR, VITAL SIGNS, 6515-01-432-2707 AND 6515-01-432-2711**

a. THE INSERTV FEATURE. When performing maintenance services, the INSERTV feature of the Welch Allyn Propaq 206EL will not function if the accessories are connected. IAW the service manual (section 2), ensure all accessories are disconnected from the unit before using the INSERTV feature.

b. PRINT HEAD ASSEMBLY DAMAGE. Upon completion of maintenance services, and anytime before placing the monitor in storage, ensure that the recording paper is not fed through the print head or remove the paper from the recorder altogether. Leaving the paper fed through the print head during periods of storage causes damage to the print head assembly. Additionally, it is a good idea to place the monitor inside a plastic bag to protect it from the elements during both short and long term storage. This also helps prevent the loss of any articles that may come loose inside the case.

### **c. RESPIRATION FUNCTION ACTIVATION.**

(1) During 2001 and 2002 several Vital Signs Monitors delivered to the USAMMA did not have the respiration function activated. Welch Allyn had provided training and loaned the equipment necessary to activate the respiration function to the medical equipment repairers at Hill AFB, UT. The equipment has been returned to the manufacturer and the USAMMA will no longer be able to activate the respiration function.

(2) The label on the left side of the equipment should provide a quick indication of whether or not your monitor has the respiration function is activated. The label displays either

ECG/EKG RESP, or ECG/EKG. If it does not have RESP, it is not installed. Additionally, when you turn the unit on if you can select RESP (2nd selection from the left), it is installed.

(3) If you are assigned to an Army TOE medical unit and have a Vital Signs Monitor that does not have the respiration function activated, contact Welch Allyn Protocol and provide them with equipment's serial number. If the serial number of your monitor is on their list of monitors procured on the contract, Welch Allyn will activate the function at no cost. Contact Welch Allyn Protocol Inc's Customer Service at 8500 S.W. Creekside Place, Beaverton, OR 97008; or call them at 800-289-2500 (select option "1" twice).

## **2-16. MONITOR, CO2 SENSOR, VITAL SIGNS, 6515-01-432-2711**

Mainstream CO2 sensor, service and replacement.

a. The appearance of a "degraded waveform error message" indicates that the Mainstream CO2 Sensor is bad.

b. Welch Allyn has recommended that the sensor be exercised at least every six weeks. This means that if the unit is in storage or not being used, the unit will have to be turned on and the sensor allowed to warm up. Once it is warmed up, an airway adapter will need to be attached and breathed into until the unit generates a waveform. This procedure prevents the sensors' motor from drying up.

c. Replacement sensors are expensive. Costs identified in this publication may differ from your actual cost dependent on source, quantity, and/or inflation.

(1) A brand new sensor, (PN 008-0502-00) costs about \$2200.

(2) A brand new sensor with the exchange/trade-in of a bad sensor is about \$1050 (includes a one year warranty).

(3) A refurbished sensor with the exchange/trade-in of a bad sensor about \$850 (includes a 90 day warranty).

(4) The part number will be generated when the user specifies what type of exchange they want. The only thing required at the time of purchase is the serial number of the bad sensor and specification of which type of exchange.

## **2-17. OPTICAL MICROSCOPE, 6650-00-973-6945**

The Bausch and Lomb Optical Microscope, Model STEREOZOOM 4, although out of production is still being issued to field medical units. Parts can be obtained through Microscope Services, Reichert Inc., New York. Their phone number is 716-686-3166 and their website is [www.reichert.com](http://www.reichert.com).

**2-18. PORTABLE OXYGEN GENERATION SYSTEMS, 6515-01-505-0203/  
6515-01-533-4481 (ON SITE GAS SYSTEMS MANUFACTURER), MODEL  
POGS 33 AND POGS 33C**

Information has come to our attention that On Site Gas Systems has not provided all of the part numbers for accessories in their service literature. Here are some additional parts and part numbers used with the POGS:

NOMENCLATURE	PART NUMBER
20 FOOT OXYGEN HOSE W/ FEMALE TO FEMALE FITTINGS	P33-040-007
15 FOOT OXYGEN HOSE W/ FEMALE TO FEMALE FITTINGS	P33-040-005
8 FOOT OXYGEN HOSE W/ FEMALE TO FEMALE FITTINGS	P33-040-003

**2-19. PUMP, INFUSION, 6515-01-452-0625 AND 6515-01-486-4310**

a. BATTERY OPERATION TESTING. When performing the battery operation test portion of the system function test for the Medsystem III 2863 and 2865 as defined on page 3-10 of the OEM service manual, Alaris Medical Systems has identified a technique that can save time and money.

(1) A one inch square piece of red (other colors not detected) silicone rubber can be used instead of a mini-set cassette filled with water. In addition to decreased costs, this also reduces the chance of the unit alarming during this test as well.

(2) Use a modified fluid side occlusion cassettes (reference appendix B of the OEM service manual, page A-8) and place a one inch square piece of red silicone in the air in line detector. Then perform tests according IAW page 3-10 of the OEM service manual.

(3) Modification of the fluid side occlusion cassette should be done as follows. Remove the rubber boot from the plunger stem and cut away all of the tubing from the cassette. Additionally the small square rubber film on top of the cassette must be removed while the large round rubber film needs to be left in place.

(4) A 12" X 12" sheet of red rubber silicone (PN 8632K34) is available from McMaster Carr for \$22.02. This can be used to make multiple one inch squares of rubber. This saves a lot of money by not having to purchase more mini-sets (PN 28125) that cost \$150.00 for a box of 50 EA. McMaster Carr can be contacted at (404) 346-7000 and (404) 629-6500.

b. LITHIUM BATTERY FAILURE INDICATION. When the Infusion Pump is first turned on after removal from extended periods of storage it is not uncommon for the pump to indicate a lithium battery failure. With the exception of clearly visible physical damage the ensuing procedure should be followed prior replacing the lithium battery.

(1) Charge the unit for 24 hours.

(2) After the unit has charged for 24 hours, place the unit into maintenance mode and connect it to a computer with FMS software supplied by the Alaris.

(3) Re-enter the pump's specific information using the software.

(4) Remove the pump from the computer.

(5) Turn the unit off and unplug the unit from A/C.

(6) Start the unit normally. Confirm the unit's serial number is displayed on the screen with no errors. If the serial number is displayed and no errors appear, the unit still requires a software calibration.

(7) Place the unit back into maintenance mode and hook it up to the computer and follow your normal procedures for calibration and clearing the error logs.

(8) If there are errors, replace the lithium battery.

C. ALARIS MEDICAL SYSTEMS TECHNICAL INFORMATION AND SOFTWARE UPDATES. Alaris Medical Systems has published guidance in an attempt to make technical information and software updates for their model: 2850, 2863, and 2865 series infusion pump more accessible and user friendly.

(1) Their web address for technical support, information regarding service bulletins, software patches and upgrades is <http://alaris.pint.com/na/technical/bio.shtml>.

(2) To order a Technical Service Bulletin, please call ALARIS Medical Systems Customer Services at (800) 482-4822.

(3) To register for online Technical Service Bulletin Access, please call ALARIS Medical Systems Technical Support at (800) 854-7128, extension 6003.

Note: This is a list of Active Service Bulletins not already incorporated in the latest revision the Technical Service Manual part number 2863012 released Apr. 94. This is not a history of all Service Bulletins.

(4) Alaris plans to release new software during 2006 for the calibration/ Verification of the MedSystem III infusion pump. Their plan is it to make it faster and more user friendly.

d. DRIVE MOTOR FAILURE. The Hill Medical Maintenance Operations Division has noticed an increase in the Drive Module Kit (P/N 2860745) needing to be replaced. The cost for this part is \$551.25 through Cardinal Health formerly known as Alaris. We have found that in some circumstances the problem can be fixed with a Motor Kit (P/N 2860760) at a cost of \$291.90. This is a cost savings of \$259.35 each.

## **2-20. PUMP, INFUSION, 6515-01-486-4310**

Alaris I.V. Pump model 2865B LCD display problems.

(1) There have been some noted problems including discoloration of the pixels, inconsistent dark and light color and uneven (blotchy) polarization, and shadows of the previous screen affecting the performance and bringing into question the reliability of the Alaris I.V. Pump LCD display. The USAMMA has concluded that the problems are common to the newer Solomon LCD.

(2) Cardinal Health Alaris recognizes this problem and has agreed to perform the necessary circuit repair for any units demonstrating this problem.

(3) The following test sequence should be considered for medical equipment repairers to test Alaris Infusion Pumps. This guideline **does not** replace any manufacturer procedures for testing or servicing their product. See Appendix G of this publication.

## **2-21. PUMP, INTRAVENOUS INFUSION, 6515-01-498-2252**

The Infusion Dynamics Intravenous Infusion Pump has an accessory called the Crystalloid and Colloid Pump Cartridge and IV Set (part number 0040-0050). Please be aware that the date on the back of the package is the date the cartridge was manufactured. There is no expiration date printed on the package. The manufacturer explained that a 3-year shelf life was specified to the Army when the infusion pump was acquired. Although it has not been tested in extreme heat, the manufacturer states that the 3-year shelf life would be shortened to 1-year shelf life if the IV Set was exposed to such conditions.

## **2-22. REFRIGERATOR, BLOOD, 4110-01-506-0895**

The USAMMA has published procedures for performing a technical inspection/service for the ACUTEMP model: HMC-MIL-1 Blood Refrigerator Unit. See Appendix H of this publication for additional information.

## **2-23. STERILIZER, STEAM, 6530-01-431-6564 AND 6530-01-442-8720**

### **SOFTWARE UPGRADE**

(1) A software update allowing the repairer to calibrate the unit from the parameters menu is available for Harvey MC10 Steam Sterilizers that were built prior to the year 2000. Although the update is not required, it significantly reduces the amount of calibration time by precluding the requirement for the repairer to open the case and go to the motherboard.

(2) Some units may have already been updated. Verification that your unit has the updated software can be done as follows:

- (a) Press and hold CONTROLS OFF, then press and hold PROGRAM SET.
  - (b) Release CONTROLS OFF, wait one second and release the PROGRAM SET button. The unit should display the LOG in the upper left corner of the display.
  - (c) Step through the selections by pressing PROGRAM SET. Use the UP ARROW or DOWN ARROW to change the selection.
  - (d) As you are scrolling through, the last parameter should be CALIBRATE if you have the updated software. If there is no CALIBRATE parameter you have an old software version.
- (3) The software update consists of an EEPROM (PN SC1203X1) available from Barnstead International/Harvey; phone: 1-800-553-0039. The cost is \$35.

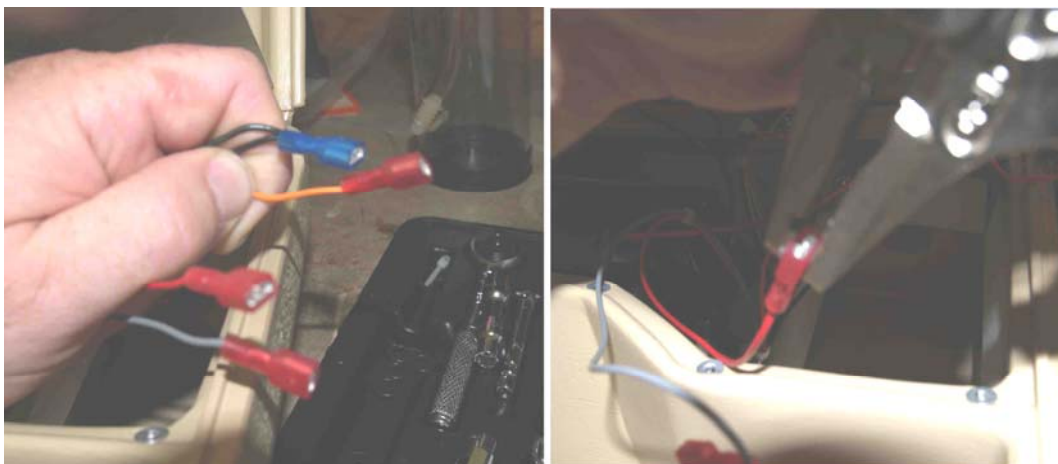
## **2-24. SUCTION APPARATUS, 6515-01-435-5350, 325M**

a. A common problem encountered with the 325M Suction Device is the battery terminals becoming loose and disconnecting from one or both of the internal battery packs. The battery is relatively difficult to get to and a disconnection will make the unit non-operational. It is imperative that the wires remain connected inside the unit to ensure reliable operation and to permit recharging. The terminals should each be squeezed separately during every scheduled maintenance, and then reattached to the battery at their proper polarity position(s).

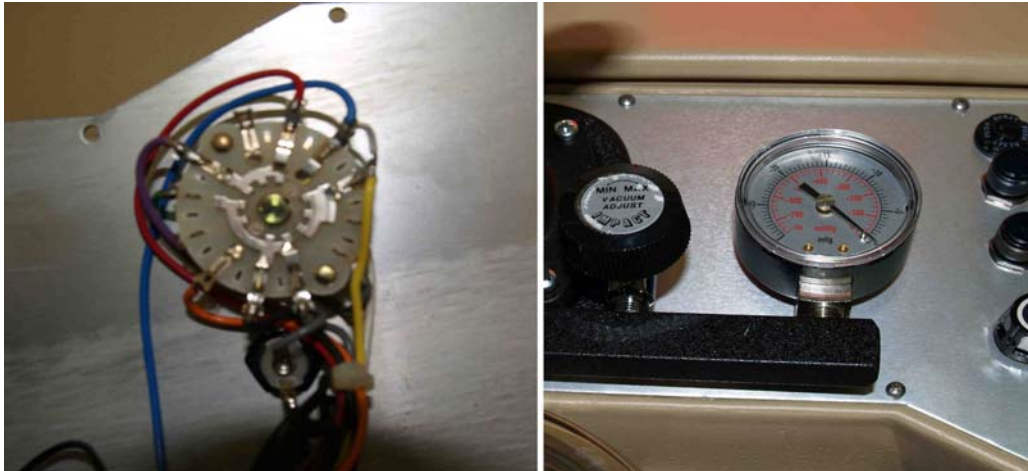
b. Another concern to be aware of when servicing this suction apparatus are the small Phillips screws which strip easily when turning them back in to reattach the unit plate. Utilizing a flat-bladed device to manipulate and position the flexible plastic molding will align the thread-hole concentric to the screw and allow successful reassembly. This precautionary procedure will prevent an otherwise good unit from being removed from mission capable status because of a damaged case. (See photos below)



c. Another frequent occurrence with the 325M happens when the operator turns the dial switch and the pump motor does not initiate. Sometimes the motor will engage between dial increment settings only. Most often the cause is the contact surface adjoining the yellow wire. It either has twisted and needs careful realignment and crimping, or the electrical path has been broken and the switch needs repair or replacement. See photos below.



d. Packaging the manual(s) or hose-tubing container inside the lid of the suction unit causes downward pressure to be applied against the moveable arm mechanism to which the gauge is attached. This forces the right corner of the gauge housing to jam against the unit plate. The internal mechanism of the pressure gauge moves independently of the housing, rendering the gauge damaged which requires replacement. See photos below.



## 2-25. SUPPORT FOR THE NEW ISO-RAD SYSTEM (PHILIPS MEDICAL SYSTEM)

a. In order to support the new ISO-RAD System, you will need to first apply for IST permissions from Philips Medical Systems. To obtain the correct permissions send an e-mail to [Coop.helpdesk@philips.com](mailto:Coop.helpdesk@philips.com). Inform the helpdesk as to what type of Philips Systems you work with so that they will be able to assign the correct permissions. Once the helpdesk has created an account, you will then need to load the following programs on the laptop that you plan on using to perform maintenance on new BuckyTH X-Ray System. That soft ware is: IST (Philips Encryption), APR MANAGER (BuckyTH APR Editing Software), AGENT (Optimus Generator interface), X-SCOPE (Table, Tubestand, Receptor interface), In-Center offline (viewing Philips documentation).

b. With this new version of IST, you will no longer need the PMS Sec Reader and the Dongle Key!

c. This will also give you access to Philips Incenter web site <https://incenter.medica.philips.com> where you can find Operators and Service Manuals, and Field Change Orders for any Philips systems that is in the field (BuckyTH (X-Ray System) BV300 (C-arm), Compano Classic (CR System), Compano Eleva (CR System), MX8000 Dual (CT) and PQS2000 (CT)).

## 2-26. SURGICAL LIGHT BASE, 6530-01-518-9854

Since the Fedmedical literature does not contain any electrical schematics for the Surgical Light Base, Appendix I of the supply bulletin includes a wiring diagram that will supplement the Theory of Operation in the literature for troubleshooting purposes.

## 2-27. TABLE, OPERATING, FIELD, 6530-01-321-5592

a. Electrical Safety testing of the surgical light (NSN 6240-01-455-7873) has disclosed that an unacceptable leakage current level exists in some of the lights that are part of the field

operating table. RTS-Medical personnel at Fort McCoy, WI, provided additional information that relates to the JT-101 and YH75A power supply PCBs.

b. If your FST OR table surgical lights have an electrical leakage problem ( $>300$  UA) follow these instructions.

(1) Step 1: Remove the plastic terminal cover at the bottom of the lamp column and make a small mark with a permanent marker on the red lead to the power supply PCB that is connected to the black lead of the incoming power cord. Continue with the disassembly of the lamp by removing the base joint assembly and middle knuckle of the lamp. Remove the two screws securing the PCB heat sink about halfway up the lamp column. Undo the wire nuts at both ends and slide the PCB out the bottom of the column.

(2) Step 2: Identify the board you are modifying and locate the hot lead.

(a) If you have an YH75A board, its number will be found on the right edge of the component side of the board. The YH75A hot lead is located on the opposite side from the part number and heat sink ground lug viewed from the component side. Trace the lead from this wire and it goes to the line fuse.

(b) A JT-101 board will be labeled on the "run" side, in the upper middle. The JT-101 board is laid out with the hot lead on the same side as the heat sink ground lug, going to a fusible link, (the very thin wire overlaying the resistor symbol silk screened on the component side). Don't be concerned if the black mark you made in step one seems to be reversed. Many of these boards were connected backwards during assembly. The fuse should always be connected to the incoming, (hot) side. If your connection is reversed, correct it now by gently scraping off the small black mark and applying a larger one to the hot lead. You may also mark the other red wire (neutral) with a white marker. This precludes any need to de-solder and replace the existing red wires.

(3) Step 3: "Float" or electrically disconnect the ground pad of the PCB. Unscrew the lug from the heat sink. Use a small diagonal cutter and snip off the lug flush with the surface of the PCB. Snip off the green ground wire where it enters the PCB. (No soldering iron needed for this step.)

(4) Step 4: Connect the isolated ground lug to the neutral lead. This step diverts risk current to neutral. Some risk current is induced due to the proximity of the runs on this board. The balance probably comes through the two filter capacitors which terminate on the ground pad. These caps are present on both power supply modules. They are thin film ceramic caps with high dielectric ratings (350 V to 3.3 kV on the samples encountered).

(5) Step 5: Acquire a 28 AWG stranded signal wire, strip it and pull out a single strand. This should measure about .010 inch in diameter. For comparison, the fusible link wire found on the JT-101 board measures about .007-inch. Solder this wire between the ground pad and the neutral pad. Use of 60/40 solder with rosin flux will facilitate this operation and probably eliminate the need for additional solder. This thin wire will carry risk current and protect the board if an equipment malfunction occurs.

(6) Step 6: Place a ring terminal on the line cord ground lead and connect it to the chassis with a 6-32 screw and nut. Drill a hole between and slightly below the screw holes for the line cord terminal cover. Face the screw head out and the cover should fit over it during reassembly of the lamp.

(7) Step 7: Reassemble and safety test the lamp using normal and reverse polarity. You may also open and close the ground switch as part of the test. This should bring the electrical leakage within ( $<300$  uA) acceptable limits.

## 2-28. TABLE, OPERATING HOSPITAL (FIELD), 6530-01-353-9883

The field operating table, model 2080, manufactured by Steris Corporation, LIN T00029, is supplied with a number of accessory components. The list of accessories supplied with the table is taken from the Medical Procurement Item Description (MPID). Appendix J shows a picture for each part. For ease of inventory and operational readiness, you should make a copy of this list and include it with the manufacturer's literature.

## 2-29. USE OF HEPA FILTER WITH IMPACT 754M VENTILATOR

a. The manufacturer's literature states that hardware calibration should only be performed after repair or replacement of the analog PCB, CPU PCB, power PCB, or flow manifold and after failed attempts at computer calibration. Hardware calibration should be performed at 50 psi. Only O<sub>2</sub> and air pressure tests are performed at 60 psi. Ensure calibration on all cylinder gauges (VT Plus). This procedure sets the baseline low and high voltages for the following seven circuits:

Signal	Low Setting	Adj. Pot	High Setting	Adj. Pot	RT-200 Function	Model 100 Gas Type
O <sub>2</sub> Flow	0 LPM: 0.5V	VR1	60 LPM: 4.5V +/- 20mV	VR2	35	Oxygen
Air Flow	0 LPM: 0.5V	VR3	60 LPM: 4.5V +/- 20mV	VR4	36	Air
Mixed Flow	0 LPM: 0.5V	VR5	60 LPM: 4.3V +/- 20mV	VR6	35	Oxygen
O <sub>2</sub> Pressure	0 PSI: 0.5V	VR7	60 PSI: 4.5V +/- 10mV	VR8	N/A (Use Cylinder Gauge)	N/A (Use Cylinder Gauge)
Air Pressure	0 PSI: 0.5V	VR9	60 PSI: 4.5V +/- 10mV	VR10	N/A (Use Cylinder Gauge)	N/A (Use Cylinder Gauge)
Barometer	Ambient: 4.5V	VR14	-10 PSI: 0.5V +/- 20mV	VR13	21	N/A
AW Pressure	0 cmH <sub>2</sub> O: 0.5V	VR11	100 cmH <sub>2</sub> O: 4.5 +/- 20mV	VR12	12	N/A

b. After hardware calibration is completed, you must perform a complete computer calibration. This software calibration sets reference voltages within the 754M Ventilator's memory. This software uses the RT-200 (VT-Plus in RT-200 mode) to regulate the flow and pressure of the gas coming through the ventilator. When the flow/pressure reaches a certain level, the computer stops the flow/pressure and retains that voltage into memory in the ventilator and proceeds to the next level. These voltages fall within the baseline values set during the hardware calibration.

**2-30. VENTILATOR, 754M, 6530-01-464-0267**

Common problems and solutions for the 754 ventilator are noted below:

PROBLEM	COMPONENT	SOLUTION
<b>A hardware calibration must be performed after any of these repairs are completed.</b>		
Low charging voltage measured at battery connector when external power connected to ventilator	U1 on the Motor Drive PCB	Replace malfunctioning chip
Ventilator will not SAVE when software calibration is performed. (Cannot read PR address)	U5 on CPU PCB is most common problem	Replace malfunctioning chip
Ventilator will not communicate at all when software calibration is initiated. (nothing happens)	U1 on DISPLAY/SWITCH PANEL PCB	Replace malfunctioning chip

**2-31. X-RAY APPARATUS, DENTAL, HANDHELD, 6525-01-425-5216**

a. A problem has been identified with the Dent X, model HDX. When trying to make an exposure with the unit yoke exposure switch, the unit does not release an exposure. When using the unit's hand switch the unit makes an exposure. The problem has been identified with an internal connector (brown and yellow wires). It falls off easily when removing the control panel.

b. When you service the unit and take the control panel off, ensure that you tie wrap the three bundles of wires that are coming out of the power supply assembly into the control panel. Securing the wires will prevent the connector from falling off and preventing proper system operation.

**2-32. X-RAY APPARATUS, RADIOGRAPHIC, MED, 6525-01-384-9296****TEXTBOOK DIAGNOSIS OF PICKER VP4 ERROR CODE "E300"**

(a) A VP-4 was indicating a E300 error code, which indicated no filament current. The Trouble shooting Flow chart the technician is instructed to replace the "CU PCB", however after the CU PCB was installed the fault condition was still not corrected.

(b) Troubleshooting action indicated open filaments in the tube or a poor connection on the cathode cable. The filaments were checked for proper impedance and the connection was checked. Both tests found no fault. After the recommended checks were made, the filament troubleshooting flow chart suggested that the computer board part number 1174-21 was bad. The board was replaced; however, this did not correct the malfunction. After a check of the schematics, it was noticed that there were two fuses on the "Power on off PCB" that affected the "Filament Drive PCB" (F2 = 2.5A 250V which Supplies 55VAC to Filament Drive Board ) & (F5 = 1A 250V which Supplies 19 VAC to the 15 Volt Power Supplies on the Power Supply Board which supplies the Filament Drive Board) one of these fuses were found to be open.

(c) The fuse was replaced and the fault was corrected.

**2-33. X-RAY APP RAD/FLUOR, C-ARM, 6525-01-452-0956**

a. During transportation the BV-300 C-Arm is prone to damage due to improper use of the rear wheel steering. The rear wheel steering increases the mobility of unit during use, but can be hazardous during transportation. Remember to keep the rear wheels facing forward and steer with the front wheel. Slight adjustments of the rear wheel control handle can cause drastic directional changes and loss of control resulting in damage to the machine or personal injury to people near the machine.

b. Later models of the Philips C-Arm do not have rear wheel steering as an option.